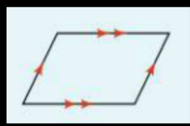
Chapter 6: Polygons

Section 2: Quadrilaterals

Properties of parallelograms

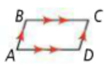
- A parallelogram is a quadrilateral with both pairs of opposite sides parallel.



Theorem 6-3

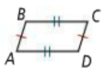
If . . .

$ABCD$ is a ▱



Then . . .

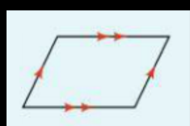
$\overline{AB} \cong \overline{CD}$ and $\overline{BC} \cong \overline{DA}$



- Opposite sides are congruent in parallelograms.

More Properties of parallelograms

- Parallelograms have special properties regarding their sides, angles and diagonals.
- Parallelograms can be used to prove theorems about parallel lines and their transversals



The Big Picture: where parallelograms fit in

- Parallelograms are a subset of quadrilaterals.
- Quadrilaterals are a subset of polygons

Polygons

Quadrilaterals

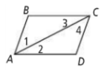
Parallelograms

Proof of Theorem 6-3

Proof of Theorem 6-3

Given: $\square ABCD$

Prove: $\overline{AB} \cong \overline{CD}$ and $\overline{BC} \cong \overline{DA}$

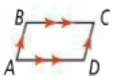


Statements	Reasons
1) $ABCD$ is a parallelogram.	1) Given
2) $\overline{AB} \parallel \overline{CD}$ and $\overline{BC} \parallel \overline{DA}$	2) Definition of parallelogram
3) $\angle 1 \cong \angle 4$ and $\angle 3 \cong \angle 2$	3) If lines are $\parallel$, then alt. int. $\measuredangle$s are $\cong$.
4) $\overline{AC} \cong \overline{AC}$	4) Reflexive Property of $\cong$
5) $\triangle ABC \cong \triangle CDA$	5) ASA
6) $\overline{AB} \cong \overline{CD}$ and $\overline{BC} \cong \overline{DA}$	6) Corresp. parts of $\cong$ $\triangle$s are $\cong$.

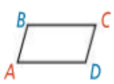
Theorem 6-4

If . . .

$ABCD$ is a $\square$



Then . . .



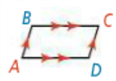
$m\angle A + m\angle B = 180$
$m\angle B + m\angle C = 180$
$m\angle C + m\angle D = 180$
$m\angle D + m\angle A = 180$

- Recall that the interior angles of a parallelogram are same-side interior angles (consecutive angles). This means they are *supplemental*.

Theorem 6-5

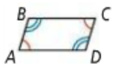
If . . .

$ABCD$ is a $\square$.



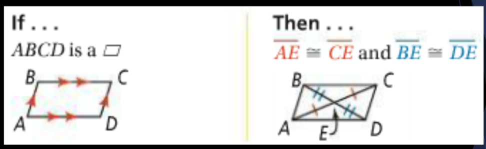
Then . . .

$\angle A \cong \angle C$ and $\angle B \cong \angle D$



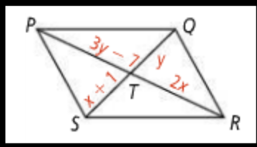
- Opposite angles are congruent for parallelograms

Theorem 6-6



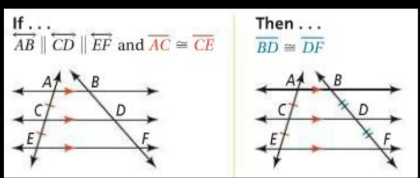
- The diagonals bisect each other in a parallelogram. Note: this does not mean the diagonals are congruent!

Theorem 6-6: application



- What are the values of x and y?

Theorem 6-7

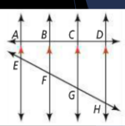


- Transversals across (3 or more) parallel lines are cut into congruent segments.

Theorem 6-7: application

In the figure, $\overleftrightarrow{AE} \parallel \overleftrightarrow{BF} \parallel \overleftrightarrow{CG} \parallel \overleftrightarrow{DH}$, $AB = BC = CD = 2$, and $EF = 2.25$. What is EH?

$EF = FG = GH$	Since ∥ lines divide $\overline{AD}$ into equal parts, they also divide $\overline{EH}$ into equal parts.
$EH = EF + FG + GH$	Segment Addition Postulate
$EH = 2.25 + 2.25 + 2.25 = 6.75$	Substitute.



- We just need to find the total length and divide it by the number of segments and/or find the sum of the segments when working this type of problem.